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cycle when many even of those regularly employed would work only part-time. (4) Finally, it should be remembered that the above figures were only averages. There was, therefore, a very large body of workers who received less than the amounts indicated.

Although it is manifestly impossible to balance these unknown quantities with any degree of even approximate accuracy, it does seem most probable from the figures of the National Industrial Conference Board itself that during the most outwardly prosperous period in our recent economic history a very large section of our working population did not receive a wage high enough to maintain a "decent" standard of living.

A CRITIQUE OF COST-OF-LIVING STUDIES

BY GEORGE E. BARNETT, *Johns Hopkins University*

The rapid changes in retail prices in recent years have since 1917 made the cost of living the dominant consideration in wage adjustments. The importance of statistical measures of these changes has correspondingly increased. In this country the first continuous index numbers of the total cost of living were inaugurated by the Bureau of Labor Statistics in 1917. They showed changes in the total cost of living separately for each of a group of fourteen cities in which ship-building was being carried on. At a later date similar index numbers were made for a number of other large cities. The material used in making the separate city indices was still later combined into an index number for the country as a whole.

Reports of its studies of the cost of living were first published by the Industrial Conference Board in August, 1918.* The Board does not calculate index numbers for separate cities, but only an index number of the cost of living in the United States as a whole. Since the index numbers for the United States issued by the Bureau of Labor Statistics and the Industrial Conference Board give figures for exactly the same thing, and since the question as to which gives the more nearly correct result is important, it seems desirable, in place of a mere technical description of the Board's index number, to compare the two index numbers as to result and method.

The difficulty in making such a comparison is that the dates for which the two index numbers are calculated are not identical. The

* *War Time Changes in the Cost of Living*, Research Reports Nos. 9, 14, 17, National Industrial Conference Board.

Changes in the Cost of Living, Research Reports Nos. 19, 25, 28, 30, 33, 36, National Industrial Conference Board.

Comparisons are made with certain studies of the United States Bureau of Labor Statistics.

index numbers of the Bureau have been issued for the following dates: December, 1914, 1915, 1916, 1917, 1918, and June and December, 1919, 1920. The Board's index numbers are for July, 1915, 1916, 1917; June and November, 1918; March, July, and November, 1919; March, July, and November, 1920; and March, 1921. In addition, a monthly estimate of change in the cost of living is made by the Board, but this is subject to revision. Any comparison of the two series must assume, therefore, that changes are continuous between the dates for which the numbers are calculated. The simplest assumption is that the change between any two dates has been by a uniform amount each month. This assumption may not be valid for any single period, but for the whole time there is a strong probability that it is substantially correct.

When the two index numbers are studied in this manner, it appears that the Board's index number shows smaller changes in the cost of living over the initial period at every date than the Bureau's index number. Until August, 1918, the difference was not large, at no time exceeding five points; but since that date it has been between ten and fifteen points. In November, 1920, for example, the Board's index number stood at 193.1, while the index number of the Bureau for December, 1920, was 200.4. According to the monthly estimate issued by the Board, the index number for December was 190.

The first explanation of this disagreement which suggests itself is the difference in the bases from which the changes are calculated. The Board's index number shows changes from July, 1914, but the base of the index of food prices—a very important part of the total—is the average of food prices for 1913. The Bureau's number has the year 1913 as its base. But this difference is not very important. The Bureau's index number shows an increase of only 3 per cent in the cost of living from 1913 to December, 1914, and over half of this increase was due to changes in food prices. The cost of living in July, 1914, was probably, therefore, not more than 1 or at most 2 per cent above the average for 1913. Obviously, the large disagreement between the two index numbers since 1918 cannot be explained by the difference in bases, although this difference lessens somewhat the amount of disagreement to be explained.

Another explanation of the disagreement has been advanced by Dr. Hugh S. Hanna in the October, 1919, number of the *Monthly Labor Review*. Dr. Hanna's article was written before the Bureau began to publish its index number for the United States as a whole, but he uses the same data in compiling his index number. According to his theory the disagreement is due to the fact that the earlier cost-of-living studies

made by the Bureau were entirely in ship-building cities, while the Board's studies covered a much larger number of cities. He estimated from studies made by the Bureau in 1918 that prices had increased from January 1, 1917, 12 per cent less rapidly in other cities than in the ship-building cities. When allowance was made for this fact, the two series agreed fairly well. This explanation cannot, however, be applied with much force to the index numbers of the Bureau after December, 1917, for since that date the Bureau has used data for a number of other cities in addition to the material for the shipbuilding cities, and it is exactly in this period that the discrepancy between the two index numbers is greatest.

Another possible source of the disagreement is suggested by the differences in the weights given to the groups of expenditure. The Bureau's index number is weighted on the basis of the results of a survey made in twenty-two cities between July 31 and November 30, 1918. The weights used by the Board are averages of the results of a number of private and official budgetary studies made at various dates from 1901 to 1917, weighted according to the number of families covered by the respective studies. Since the most extensive of these investigations was the 1901 study of the Bureau, the weights used by the Board are nearly the same as the figures given by that study. In brief, then, the Board's index number is weighted by a distribution of expenditure found in 1901 and the Bureau's number is weighted by a distribution of expenditure found in 1918.* The two systems of weights are as follows:

PER CENT OF THE TOTAL EXPENDITURE

	Board	Bureau
Food	43.13	38.2
Clothing	13.21	16.6
Shelter	17.65	13.4
Fuel and light	5.63	5.3
Sundries	20.38	26.4†

It will be noted that in the Board's system of weighting relatively greater importance is attached to food and shelter, while less importance is attributed to clothing and sundries. If the prices in all groups had advanced equally, the system of weighting adopted, obviously, would have been a matter of indifference. On the other hand, if food and shelter had advanced at a more rapid pace than clothing and sundries, or vice versa, a considerable difference in the index numbers would have

* Neither, of course, is the best system of weighting; the ideal system would be one based on the distribution of expenditure in 1913 or 1914.

† In the Bureau's classification of expenditures, sundries are divided into "miscellaneous," with a weight of 21.3, and "furniture and furnishings," with a weight of 5.1.

been attributable to the differences in weighting. As a matter of fact, however, the changes in the prices of the different groups have been of such a compensatory character as largely to nullify the importance of the difference in weighting. Even at the dates where the disagreement due to this cause is greatest, it does not appear to be more than a few points, and it is variable in amount.

It is obvious that none of the differences in construction which have been noted is sufficient to account for the regular, and, since January 1, 1918, fairly large disagreement between the two index numbers. An examination of the index numbers for the component groups of expenditure proves to be a more satisfactory clue. The index numbers for food and fuel and light in the Board's calculation agree with the index numbers for the same groups in the Bureau's calculation. The Board uses the index number for food as calculated monthly by the Bureau. The Board's index number for fuel and light is based on questionnaires sent to a large number of cities. "The changes in the cost of anthracite and bituminous coal are weighted according to their importance for domestic use," and the combined figure for fuel and light is obtained by using a system of weights based on the assumption that "about one-third of the average family expenditure for fuel and light goes for light and about two-thirds for fuel." The Bureau of Labor Statistics has never published any information, as far as the writer is aware, regarding the methods by which it computes its index number for fuel and light. However, since the two index numbers agree fairly well, it is useless for our present purpose to conjecture as to differences in methods.

When we examine the three other groups of expenditure—clothing, housing and sundries—we find not only that the two sets of index numbers do not agree, but that the differences between them are of a fairly regular amount. The index number of the Board for shelter is higher than that of the Bureau for housing, while the index numbers of the Board for clothing and for sundries* are considerably below those of the Bureau. The sum of the differences in the index numbers for clothing and sundries *minus* the difference in the index number for housing, when weighted by the value of these groups in the total cost of living, gives an amount which accounts approximately for the disagreement between the index numbers of the total cost of living.

The differences between the discordant group index numbers are so constant as to suggest fundamental dissimilarities either in material or method. Unfortunately, the information disclosed by the makers of

* The Bureau's index numbers for miscellaneous and "furniture and furnishings" have been combined into a single index number, which is here regarded as comparable with the sundries group of the Board.

these index numbers is not sufficient to make it possible to probe the question thoroughly. In what follows, therefore, only the most superficial analysis has been made.

The index number for shelter used by the Board, as has been said, runs uniformly higher than that of the Bureau for the same expenditure. It is possible to carry the analysis of this index number a step back, since the changes in the cost of housing are given for individual cities by both the Bureau and the Board. When these changes are compared, it becomes clear that the reason for the difference in the index numbers lies primarily, if not entirely, not in the method of averaging the increases in different cities, but in the differences in the amounts of change found by the Board and the Bureau for the same cities. The Board's figures are almost without exception higher than those of the Bureau. For example, the increase in the cost of housing in Philadelphia is estimated by the Board for March, 1921, as 51-60 per cent, while the Bureau's estimate for December, 1920, is 38 per cent and for May, 1921, 44.2. In the absence of detailed statements of the methods employed in collecting the material, no explanation of these differences can be made. The method employed by the Board is to send questionnaires to "real estate boards, brokers, chambers of commerce, social organizations and individuals." The exact form of the questionnaire is not revealed, but from the miscellaneous character of the sources of information it may be presumed that an estimate of the amount of change is requested. The answers to such a questionnaire probably exaggerate the changes in rents. If a real estate broker is asked how much rents have risen or fallen in a given period, he is likely to place too much weight on the changes which have come to his attention and insufficient weight on the cases in which no changes have occurred. If the Bureau of Labor makes an actual study of the books of real estate agents, its figures for changes in rent are probably better than those of the Board.

There are two important differences in the methods used by the Board and the Bureau in making their index numbers for the cost of clothing. In the first place, the Bureau averages changes in the prices of various articles of clothing to find the change in the cost of clothing for each city, and then averages the city index numbers to find an index number for the United States as a whole, while the Board averages directly the returns from a number of dealers in different cities. The Board draws its quotations from a larger number of cities. Secondly, and a more likely cause of the disagreement, is the difference in the systems of weights. The Bureau's index number for clothing is unweighted, while that of the Board is weighted on the basis of a clothing budget. In the absence of the detailed price figures used by

the Bureau, it is impossible to establish the effect of this difference, but the presumption is strongly in favor of a weighted index number of clothing.

As has already been noted, the group of expenditures which is called sundries by the Board is divided by the Bureau into two groups known respectively as miscellaneous and furniture and furnishings. The index number for sundries is made by the Board from prices of "car fare, doctor's fees, church contributions, organization dues, insurance, reading, amusements, candy, soft drinks, tobacco, furniture and furnishings, and household supplies." But only rough estimates of changes in the prices of these articles are made, and the weight assigned to each of these articles or groups of articles is not stated. The Bureau of Labor Statistics does not publish the list of articles included in the miscellaneous and furniture and furnishings groups, nor the system of weights employed. Even conjecture as to the cause of the disagreement is, therefore, impossible.

In what has been said above, attention has been directed to the disagreement of the two index numbers. From a wider point of view, their correspondence is more important. For many years the question of devising a more adequate measure of the cost of living than the index number of retail food prices has been discussed, and the opinion has frequently been expressed that the difficulties to be faced were insuperable. When differences in material and method are taken into account, the substantial correspondence of the two index numbers here compared is the best proof that such a measure is practicable. Neither the index number of the Board nor that of the Bureau is the last word in measures of the cost of living, but they possess the great merit of having demonstrated the practicability of such measures. The index number of the Board has contributed materially to establishing the influence of measures of change in the cost of living in wage determinations. The more frequent appearance of the Board's index number has facilitated the use of such measures of change, and its general correspondence with the index number of the Bureau has greatly enhanced the prestige of such measures. The Board has done a useful piece of work and it is to be hoped that the maintenance of an index number of the cost of living will be a permanent part of its work.

ON THE BEST FORM OF INDEX NUMBER

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There is undoubtedly at the present time a keener interest in price fluctuations and a better understanding of index numbers as a measure